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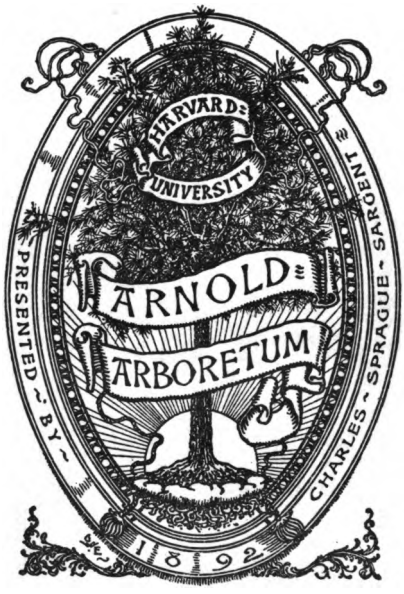

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CAPE OF GOOD HOPE

Department of Agriculture.

TREE PLANTING FOR TIMBER AND FUEL.

C. B. McNaughton

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TREE PLANTING FOR TIMBER AND FUEL.

A Municipal Undertaking.

The Rust-en-Vrede Scheme at Oudtshoorn.

(By C. B. McNaughton, Conservator of Forests, Midland Conservancy).

In passing through Oudtshoorn late in May last I made enquiries as to whether the Town Council had yet seriously considered the advisability of establishing a timber and fuel plantation on the land purchased on the Cango River in connection with the town water supply—a scheme suggested by myself some time back and referred to in my Annual Report for 1901 (p. 71). I was agreeably surprised to hear that the matter had just been taken in hand, and that a resolution had been passed at a previous Town Council meeting to approach the Government on the matter. Under the circumstances I called upon the Town Clerk and ascertained the particulars of this resolution, as also of the letter written to the Government on the subject. On this I determined to act, and after having interviewed certain members of the Tree-planting Committee of the Town Council, arranged for a visit to the proposed site—Rust-en-Vrede—which was made in company with Mr. Doy, Town Clerk, on the 23rd May last. In submitting the report following I must apologise for its somewhat sketchy nature as time did not permit a very careful inspection of the whole area, and the meteorological records available are not sufficiently complete or extensive for any minute suggestion or recommendation—though possibly a general expression of opinion may prove sufficient for present needs.

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General.

The scheme itself is one to be highly commended not only for the certain economic advantages, but also for the indirect benefits that the establishment of a large plantation of selected timber trees will ensure.

In the recommendations made by the Committee of Experts specially appointed in January last to inquire into and report on the subject of British Forestry, is seen the following :—

> "That the attention of corporations and municipalities be "drawn to the desirability of planting with trees the catchment "areas of their water supply."

This recommendation coming from the leading authorities as it does, requires no explanation or endorsement, for its arguments, generally widely known, are irrefutable. The Town Council at Oudtshoorn do not intend at present to plant upon the catchment area of their supply, but rather land available below the intake of their pipe system. The work however, will prove a highly valuable object lesson to the country in as far as it will shew the effect of afforesting a catchment area which serves farms situated below the Town Council property in the same valley—farms which are said to be at present insufficiently supplied with water at certain seasons owing to the town servitude on the main source of supply. The successful establishment of such a plantation should prove of great service in the encouragement of tree-planting on an extensive scale in a district where so much in this direction should be done, and I would strongly recommend that the scheme should be supported in every way by Government both in regard to grants possible under Act 4 of 1876 and to advice and general assistance in the carrying out of the project. Personally my services, with the sanction of Government, will always be readily given when possible. As this report is intended to be only of general assistance in the establishment of a plantation under conditions which are perhaps not altogether similar to those which any practical example in the Colony has experienced, and further as the work must necessarily be left in hands possibly not highly experienced in the introduction and establishment of timber exotics, a few remarks on the general laws which govern such introduction may not be out of place, so before making any special recommendations I have inserted a short resume of such general sylvicultural principles as may be of interest, and a few notes on the forest nursery including seed germination and the handling of transplants.

In the introduction of exotics a main point to be considered is the temperature of the atmosphere during the growing season of the year, indeed a knowledge of the summer mean is almost fundamental. Forest species may be grown far from their natural habitat provided that the local climate is similar to that to which they are naturally accustomed. To some extent differences in aspect and soil locality may compensate for certain differences in climatic conditions,

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such as the introduction on a warm and dry aspect of a species hailing from a somewhat warmer climate, or on a cold aspect and moist locality that which is naturally accustomed to a colder climate. While it is undoubted that species will accommodate themselves to a change of seasons—flowering and fruiting, etc.—when introduced from one hemisphere to another there is abundant proof that no adaptation is possible to a new or differing climate where this difference is in any way marked. The climatic needs of a species are best determined by a comparison of those which obtain where the species is found naturally. Latitude and altitudes furnish a fair but not quite reliable guide for they may be affected by natural phenomena such as the prevalence of sea breezes etc. etc. The blizzards of Florida form an instance of this fact. As a general rule in low lying lands, latitudes frequently limit the habitat of species, subject of course to such modifying influences as aforementioned and in higher country latitude and altitude combined.

From this fact it is no unusual thing to find a species with two habitats—and classed as a mountain species in one place and a plain species in another. At Rust-en-Vrede an instance of this is seen. Above the "intake" at about 2,800 feet above sea level specimens of the Ilex capensis or Wittehout are to be seen, a species found commonly on the lower Knysna forests plateau, where the mean maximum summer temperature probably corresponds.

In introducing an exotic species it should be remembered that the conditions of light and heat are similarly related, and that in proportion to the differences of the natural climatic conditions and the new conditions in which it is attempted to introduce exotics so will be the difference in their light and shade demanding requirements. If brought to a warmer climate their shade bearing capacities are greater and if to a colder their light requirements will be higher.

Another very important factor to be considered in all afforesting questions is the degree of air moisture, more especially in the growing months of the year. In North America it has been determined that where the tension of water vapour averages less than 0·50 during the four growing months forests practically cease. Oaks and 2—3 leaved pines fear least, it is said, the neighbourhood of the dry zone, while firs, spruces, cypresses and 5 leaved pines are found only when approaching the moist zones (Mohr). Where the atmosphere is very dry or subject to sudden variations broad leaf species are to be preferred for experimental forest work and then 2—3 leaved pines The moister the atmosphere, the easier becomes forest culture, both in regeneration and subsequent treatment, and especially is this so during the growing season. Indeed if the mean rainfall for the four growing months, falls below 2 inches and even if the contained air moisture remains always above 50 per cent, true forests disappear unless perhaps where the winter rains are exceptionally heavy or where in the neighbourhood of bodies of water there is a good subsoil percolation. With age the drought resisting capacity of trees increases and mature trees are capable of withstanding often

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prolonged periods of very dry weather without suffering much harm.

With regard to soil requirements, most trees, in their most suitable climatic situation, are to a great extent polyphagous or in other words if in introducing exotics very suitable climatic conditions are obtainable, the soil of almost any mineral formation will suffice, provided always that its physical properties are suitable. It will suffice for successful growth but not for the best quality of produce, a fact which is well instanced in the Jarrah forests of West Australia, where the quality of the timber varies with the geological formation on which it is found. Of course to this general rule there are notable exceptions, such as sweet Chestnut, Cluster Pine, etc, where success depends—other conditions being suitable—on the presence or absence of lime both species being calciphobous. In Oudtshoorn the calciphobic properties of the Chestnut is instanced by the prevalence of dry rot and often by the death of trees before middle age in soils with a lime percentage approaching 4.

(This condition may also be caused by excess of moisture).

Adaptation to climate is however the main consideration when the introduction of plant material is intended and probably there is no climate where human life is possible that is impossible for plant life in some form and, within narrower limits, for trees.

In certain extremes there can necessarily be no expectation of the eventual production of trees of high economic value, but arboriculture, with its attendant climatic amelioration, is nearly always possible within certain latitudes.

In agriculture it is a more than evident fact that the rapid progress of any new country is based, not on possible development of the natural or endemic species but rather on the discovery that its climatic and soil conditions are specially suitable to the culture of some introduced or exotic plant or plants of great usefulness to the human race. In Oudtshoorn is this axiom most evident: its present prosperity rests mainly on the tobacco, the vine and the lucerne—exotic plants which flourish under the climatic and other conditions obtaining.

In afforesting, the principle is to a great extent true as well, though the conditions are naturally more limited. In a country with a rich forest flora much can be done once a thorough sylvicultural knowledge of the different species is acquired in addition to a fair understanding of their economic possibilities. Few countries however possess so wealthy a flora as to include species to cover all practical requirements, and naturally the successful introduction of an exotic supplying the natural deficiency is economically successful in proportion to its want. North America for instance possesses a wonderfully rich forest flora but has nothing which it can offer as a substitute for the cork oak, and in view of the large wine industry in parts of the country the establishment of this tree has become a matter of considerable economic importance.

In a country like South Africa, with a limited forest flora, comprising principally slow growing hard woods confined naturally

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to certain small areas, it is undoubted that economic afforestation will depend on the proper selection and introduction of useful quick-growing exotics suited to the varying climatic and other conditions which obtain. Cultivation of the indigenous species can only prove profitable under very limited conditions. Generally speaking the vast eucalypt family furnishes a wide range for selection of quick growing and fairly valuable woods. Professor Charles Naudin gives concisely the main conditions for a successful growth of the species. He says:— "The first condition of success in the culture of the Eucalyptus is a climate appropriate to their nature: that is to say, for a great majority of the species, warm summers, a moderate amount of rain, a certain atmospheric dryness, plenty of sunlight and very temperate winters." These conditions can be found in many parts of South Africa. To Australasia, parts of Asia, Southern Europe, Northern Africa and parts of the United States of America we look for other trees suitable to local conditions. Many have already proved themselves suitable and others have been found unsuccessful, but where the climatic conditions are sufficiently known to admit of comparison the chances of failure should be much minimized.

Propagation.

In planting up areas with forest trees the stock must either be purchased from a nursery or raised. According to the quantity required will be the economy of the two methods—other things being equal—but where heavy transport is incurred and delays in delivery experienced it is almost always preferable to raise the plants on the site of the future plantation.

Seeds.

Too much importance cannot be attached to this subject. The identity of the seeds is of the very first consideration as mistakes made are not easily detected untill much valuable time has been wasted, let alone the expense incurred. It is generally preferable to obtain supplies direct from some responsible and reputable dealer and to sow as soon as possible after receipt. In the Colony tree seeds may be obtained from the Government Seed Stores at a fixed tariff. Not infrequently seed may be gathered locally, but a mistake often made is to collect from immature or sickly trees which not unusually produce large easily gathered crops. Seed should always be gathered from mature, healthy trees, for it must be remembered that while certain qualities which go to produce the healthy tree are non-transmissible through the seed, and that the condition is due to suitability to the locality factors, yet disease and other defects are transmissible and that it is a safe working rule to consider that an unhealthy seed bearer will produce unhealthy seedlings.

On arrival all seed should be carefully examined and tested for vitality. This can be done roughly by cutting and inspecting a proportion of the seed or more accurately by any of the germination

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tests. Of these the sand and sphagnum method is probably the best and simplest. It is known to most nurserymen. With different species the proportion of perfect seeds in good fresh samples will vary very much from 5 per cent. to 95 per cent. Pines usually give a high percentage and cypresses a low one and this fact must be remembered before quarrelling with the seedsman. Knowing the proportion of sound seed and the stock requirements it is easy to calculate the quantity of seed to sow and thus save unnecessary expense in raising and handling unrequired stock.

Sowing of Seeds

The propagation of tree seeds is very similar to that of ordinary garden seeds and can be easily conducted by most gardeners. The main factor in successful propagation is the proper condition of the germinating bed—the soil should be light and sandy, and moderately fresh and porous. Heavy soils should be avoided as well as fine compact ones which are in the habit of caking and thus interfering with germination. The bed should be kept at as even a temperature as possible and at about the same degree of moisture.

The proper covering of the seed is another important matter. Seed should never be sown too deep, twice their own depth is a fairly safe rule. With some of the very fine eucalypt seeds sowing on the surface and pressing firmly and evenly with a small board or roller is quite sufficient, but in these cases it is advisable to cover up with two or three folds of coarse open sacking such as is known as "hessian" and water through the material. Some very successful nurserymen cover all their sowings with a layer of one to two inches of chaff and water through this. The covering allows the water to percolate slowly through to the soil, holds the moisture well and prevents caking or packing or the washing away of the seed. Of course at the first sign of germination the coverings, either chaff or the sacking, must be removed.

At Oudtshoorn I would recommend always the use of coverings and sowing in shallow boxes or pans—half paraffin tins cut longitudinally, are found very suitable. With boxes the sowings can be easily handled and this is important where night frosts are to be feared. It is most important that these boxes should be well drained as any moisture is likely to cause "damping off"—a fungoid disease which it is difficult to check and is very destructive. As the seedlings come up, a certain amount of shading will be necessary. Screens made by stretching hessian on convenient frames will probably be found to be most suitable. They should be placed about 18 inches above the seedlings to protect them from the direct rays of the sun, a protection which will be necessary until the secondary leaves are formed when the young plants can be gradually hardened off prior to transplanting. After this operation the shading should be repeated for the first few days until the young transplants have "settled in." When to transplant will naturally depend on the species but generally the best time is as soon as the

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plants can be handled, which is often as the secondary leaves are nearly formed. Of course certain species, such as the Chestnut, do not transplant at all easily and these are best raised in situ. It is best to transplant into boxes similar to those used as seed pans—half paraffin tins—each of which will contain from 20 to 30 transplants. The soil in these boxes should be something similar in *quality* to that into which it is proposed to plant permanently. It is a common mistake to transplant into a rich forcing soil so as to show vigorous looking transplants which generally suffer when they are put out permanently under poorer conditions. Of course it is not easy to estimate exactly future conditions, but it is generally safe to have the soil in the transplant boxes of fair medium quality only, but well worked and sufficiently light to permit of the young plants forming good compact root systems.

In Oudtshoorn early Spring or late Winter planting is possible, though August—September seems the best time. This must be remembered when raising the transplant as it is advisable to plant out as early as possible with most species as the young plants should not be left in the nursery too long.

Planting Out.

In planting permanently the opportunity of an overcast and cloudy day should be taken and care should be observed that the root systems of the young transplants are not unnecessarily exposed as in a dry atmosphere such as obtains in Oudtshoorn, very little exposure would be sufficient to cause damage. It is always best to plant with the ball of earth which encloses the roots of the plants. This can be easily obtained by taking out each transplant from the transplant box with a small gardener's trowel. In cases of plants which cannot be treated this way it is found a good practice to puddle the roots as soon as the plant is moved from the nursery bed or taken from the packing in which it has been transported. A good puddle is made by mixing equal parts of fresh cowdung and loam with sufficient water to reduce the mixture to a good sticky consistency. The roots are dipped into this mixture and then heeled into a good fine soil which adhering to the dung mixture furnishes a protective envelope for the tender rootlets. Transplants thus treated can be far more safely handled later when placing out permanently.

This may conclude the remarks under this head for in planting out permanently the site, degree of cultivation, method of planting, planting distance, etc. etc. will depend on the requirements of the species treated. Generally cultivation as for an ordinary cereal crop, pit planting (20 inches by 20 inches by 15 inches) and six feet by six feet apart will be the ordinary lines followed.

Rust-en-Vrede—Plantation Scheme.

Rust-en-Vrede is situated to the N.E. of Oudtshoorn and about 21 miles distant from it. It is connected with the town by a

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fairly good road for the most part—as far as the junction at Schoeman's Hoek—and by a road which a comparatively small outlay would render quite practicable for timber transport for the remainder. It is possible that it may be served to an extent by rail communication should a light line be constructed to the Cango Valley from Oudtshoorn. At the base of the Zwartberg Mountains and at an elevation of 2200-2800 feet above sea level its position is approximately 33° 28′ S. Lat. and 22° 30′ E. Long.

The principal soil forming rocks appear to be sandstones, clay slates and here and there a dark blue schistose rock. To the south of the homestead and quite close to it a dark blue crystalline limestone is to be found interbedded apparently with clay slates. The soil appears to vary somewhat both in character and depth—sandy and stiff clays predominating—varying probably with the percentage of contained lime etc. The whole appears to be very suitable for tree planting.

With regard to climatic conditions it is somewhat difficult to obtain any fairly accurate estimate, as no sufficient meteorological records exist nor are any apparently available for the district, for not even a second order meteorological station has been established, within its boundaries, as far as I am aware, but I write under correction. Fortunately at Rust-en-Vrede two rain gauges were put up, in connection with the surveys etc. for the town water-works, and while the rainfall measurements taken with them appear to have been somewhat interrupted during the recent invasion of the Colony, some information is available.

From what is possible I have drawn an average monthly chart, which I attach, and compared it with that obtained from a good many years' observations in the town of Oudtshoorn situated some 1400 feet lower. The rainfall appears to average about 24 inches per annum as against 9·34 for Oudtshoorn with a summer (October—March) percentage of about 50 degrees. The principal rains appear to fall about late autumn or early spring, the heaviest probably in the latter season.

With regard to the other climatic conditions only a rough guess can be made, based on a comparison with records in other parts of the country and applying a correction of a decrease of 1·5° Fahr: for an increase of 1° of Latitude and a decrease of 3° for every 1000 feet of elevation above sea level. This correction agrees generally with observations made in this country though it is claimed that in the main plateaux of South Africa a difference of only 1° for every 440 feet of elevation is more consistent with fact. For present purposes therefore the following figures may be taken as a guide to the mean monthly temperature :—

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	Mean Max.	Mean Min.	Absol. Max.	Absol. Min.
Summer.				
October ...	66°	43°	80°	29°
November ...	73	44	84	38
December ...	78	52	93	46
January ...	80	52	92	45
February ...	81	54	88	41
March ...	77	50	90	38
Winter.				
April ...	73	50	88	39
May ...	65	41	76	33
June ...	60	36	72	27
July ...	58	36	72	28
August ...	58	36	76	30
September ...	67	41	81	32
Means ...	70	45	83	35

The mean temperature for the summer months may be taken as 75°; the maximum temperature likely to be experienced as about 93°, and the minimum at about 27° or 5 degrees of frost. It must be remembered that ground temperatures will prove somewhat lower than this and some ground frost may be expected as late as October. It would be advisable to establish a set of instruments consisting of two sets of thermometers, maximum and minimum, for observations at the usual height in a Stevenson's screen and at ground level and the ordinary wet and and dry bulb thermometers and barometer. Very possibly the Meteorological Commission would supply what is necessary as the station cannot fail to prove of interest. Of course this can only be done when the instruments can be placed in the charge of a competent person.

While I could gather little or no information as to actual observation it seems probable that heavy winds from the northwest or northerly direction are experienced and that especially in the upper portions of the farm there is some danger from mountain fires, as the veld here has the appearance of having been burnt on several occasions.

Having roughly assessed the conditions the following recommendations appear called for:—

Preliminary Works.

1. *Appointment of a Superintendent.*—The first matter is the appointment of a competent officer to take charge of the work. The Town Council has asked for a Government nomination as it appears the services of their own officer in charge of the Oudtshoorn town

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work cannot be spared. I have suggested the name of Mr. E. Ogston, who has considerable practical experience in nursery work etc. in the Colony—and the Council have already communicated with him and I trust made satisfactory arrangements.

2. *Buildings etc.*—The present homestead is to be placed, I believe, in a proper state of repair, and when this is done should provide suitable accommodation for the Superintendent etc. Arrangements will probably have to be made for housing what labour is required, for this will have to be obtained from elsewhere—the local supply being very limited.

3. *Water Supply.*—It is more than probable that at first hand watering of the transplants put out will be necessary. Small dams should be made at convenient places and as much water conserved as possible.

4. *Roads.*—All permanent roads should be laid out before commencing work in their probable vicinity, and especially the main approach to the homestead. It would be advisable to have them at least 40 feet wide so that they may serve later as fire lines. A good system of roads is of great advantage to any large plantation.

5. *Fencing.*—It will be necessary only to fence as the work proceeds, enclosing only what is about to be planted and what is planted. The work should be well done and specially designed to keep out sheep, goats, etc. This work will prove at first a somewhat expensive item but it cannot be avoided.

6. *Nursery Site and Formation of Nursery.*—No elaborate nursery is necessary as it will be found economical later to move it with the planting. The site should be somewhat sheltered though not too much so on account of frost danger, and close to permanent water. It should be roughly levelled and properly drained. A few portable screens, some rough platforms and frames, a supply of paraffin tins and some ordinary gardening tools inclusive of cans, sieves, etc. is all that is necessary.

A convenient site at first might be the old garden.

7. *Meteorological Observations.*—Should be commenced as soon as possible and properly recorded in a book kept for the purpose. If a set of instruments cannot be obtained from the Meteorological Commission, one should be purchased.

8. *General Work.*—All planting work should be laid out—the ground properly prepared and fenced, a season in advance. When the planting period approaches the area should be pitted, the material extracted, broken up and properly weathered and then replaced ready for the receipt of the transplants as planting weather serves. The surface of the refilled pits should be slightly sunken below the general surface to enable them to hold what water is necessary for the establishment of the transplants.

As regards the scheme of work I would suggest working from the present S.W. boundary below the homestead up the valley in which is situated an old orchard site, then along the valley stretching

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up towards the water house and then on to the intake. Of course the work must depend on a water supply of some kind as the plants have to be started but difficulties will diminish as the planting proceeds. It should be an object to form a strong shelter belt on the northern and northwestern boundaries and then plant up under their protection, but probably it will be found more practicable under the conditions to plant up as much of the valleys as is possible as the work proceeds and work up as before mentioned.

All work should be protected by a good and sufficient fire line at least 30 feet wide situated *outside* the line of fencing. The veld in northern portions should also be occasionally burnt off in protection belts.

What to Plant.

What to plant is a question which must depend, apart from suitability to the factors of the locality, on the objects of the plantation. These objects I assume, would comprise :—good serviceable building timber, durable posts and fencing material and a fuel supply. Possibly to a farming community such as that in Oudtshoorn the matter of posts and fencing material may prove the most important.

In the selection of species, probably suitable to the locality, I have endeavoured to keep these objects in view while confining my selection to as few varieties as is expedient. I now give a list of these selections and under each species have added a few notes on its more important characteristics which may be of interest to those entrusted with the final selection, and to the list itself is appended a short grouping of the species under the heads of their more important economic uses.

Eucalyptus diversicolor Karri Gum.—Thrives best in moderately moist stituations near the coast and prefers a rainfall of 30 inches to 40 inches. Is somewhat susceptible to prolonged drought especially when young but is frost resisting to a great extent.

Has been successful in Oudtshoorn where the average rainfall is under 10 inches with a little irrigation and has proved itself as hardy as Blue Gum.

The tree is of rapid growth and attains enormous dimensions. The timber is excellent for general purposes though it is not as lasting under ground as some other eucalypts.

Will probably prove very successful at Rust-en-Vrede if planted in any but the driest localities, provided that a little watering in early youth is possible.

E. sideroxylon. Red Ironbark.—A tree of medium to large size, usually of erect growth and even trunk, the Red Ironbark is one of the very useful eucalypts. The foliage and blossom are quite distinctive and of very pleasing appearance. The tree endures a minimum temperature of 16°—20° Fahr. and a maximum of 110°—112°.

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A description of the timber, etc., has already been furnished the Council with the identification of a specimen some 24 years old now growing at Oudtshoorn.

Though somewhat slow growing compared with some of its congeners it is to be recommended and will prove valuable at Rust-en-Vrede, as it may be planted on the drier localities.

E. globulus.—This is undoubtedly one of the most generally useful of the eucalypts, and one of the hardiest.

A full account of the tree by the writer appears in the *Agricultural Journal*, Vol. XXI., No. 6, pp. 567-588.

It should not be neglected at Rust-en-Vrede.

E. corynocalix. Sugar Gum.—Attains a fair size, from 75 to 100 feet, and is commonly symmetrical and erect. Is usually of fairly rapid growth, though not quite that of *E. globulus.* This tree will grow in a variety of climates, and while preferring moisture will endure great drought. It will endure a maximum summer temperature of 110° to 115° Fahr. and a minimum winter temperature of 20°-25°.

It is one of the most generally useful of its species. The timber furnishes excellent fencing poles and railway sleepers, being very durable under ground. It warps little in drying, and when dry is very hard. It is much sought after for the naves and felloes of wheels.

E. tereticornis. Forest Red Gum.—This tree attains a good size under favourable conditions. It is of fairly rapid growth, probably two-thirds of that of *E. globulus.* It is usually of straight habit with even boles when grown in group. The species thrives under a great variety of climatic conditions, and will withstand maximum temperatures of 110°-112° Fahr., and minimum temperatures of 15°-20°.

The timber is hard, heavy and durable, of a red colour. It is specially to be recommended for outdoor work. In the Victoria Colony it is placed at the head of its commercial timbers.

Eucalyptus crebra. Narrow-leaved Ironbark.—This tree attains a height of about 100 feet and a diameter of 2—3 feet. The trunk is usually very straight and non-tapering. The species thrives under many climatic conditions, and endures maximum temperatures of 110°-118° Fahr., and minimum temperatures of 18°-20°.

The wood is highly prized in Australia, being hard, tough, and elastic, of reddish colour, and extremely durable. It is used for posts, piles, and for other purposes, where timber has to be placed in contact with ground; for wagon making and a variety of other technical purposes.

Castanea sativa. Sweet Chestnut.—This tree, a native of South Europe and temperate Asia, has already been successfully introduced into Oudtshoorn. It does not thrive on calcareous soils, and is said to be unable to grow in those with a 4 per cent. lime percentage. It prefers deep, loose, well-drained soils, and while it will grow in moist localities here, developes heart-rot at an early age.

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The timber is light, cross-grained, strong, elastic, and exceedingly durable, and is specially prized by carriage builders.

In the wine districts in the Cape Colony this species has an exceptional value, especially where espalier cultivation of the vine has succeeded the old dwarf stock as a result of the graft system of propagation which has followed or been necessitated by phylloxera devastation. This value consists in its wonderful coppicing capacity and very rapid production of extremely durable poles. In Upper and Lower Elsass the species is largely cultivated as coppice forest, with a rotation of 12 to 16 years. Poles are produced 20 to 24 inches in circumference at the butt and 36 feet long. These poles are used mainly as vine props, though they produce excellent staves, and will last it is said twenty years in the ground and another ten with repointing. The yield per acre is enormous. In the *Algemeine Foret und Jagd Zeitung* (September, 1896), Mr. Hallbauer gives an account of the treatment. It is found that the best results are obtained by planting out in lands which have been cultivated for two or three years. The seedling plants are cut down to a stock at an age of 6—8 years, the produce being then used principally as firewood. (The Chestnut is difficult to transplant in many cases, and is best raised *in situ*). The coppice reaches maturity at from 12—16 years, and is then cut over and the stools allowed to recoppice. As the chestnut is very shadebearing careful thinnings are always necessary.

The *Robinia pseud-acacia* which thrives in many parts of the Karroo, is treated similarly and the cultivation is almost identical, the objects being the same. The latter tree is more indifferent to depth and quality of soil but perhaps more exacting as regards good drainage and loose condition.

Both trees are well worth trial, as coppice, at Oudtshoorn, for if vine props are not yet necessary they may become so, and poles and the class of timber they will yield will always prove valuable. The wood of the *Robinia* is hard, heavy, close-grained and compact, extremely durable and valuable in construction and turnery work.

Cupressus macrocarpa. Californian or Monterey Cypress.—A tree 45 feet to 65 feet in height, growing naturally on granitic and clay slate formation on the sea coast of California. The wood is moderately heavy, hard and strong, compact clear grained, easily worked and very durable.

Has proved successful in many parts of the Colony and flourishes in the higher altitudes of Natal. May be successful in parts of Rust-en-Vrede.

Cupressus torulosa. Nepaul Cypress.—A Northern Indian cypress reaching a height of 120 feet, from the outer ranges of the Western Himalayas, between 5,500 and 9,000 feet, found chiefly on limestone formation. In Northern India it has been a good deal planted. It is easy to rear and grows fast. The wood is light about 38 lbs. per cubic foot—and is very durable. It is recommended for building, railway sleepers etc. The species may prove of value in the Zwartberg Mountains.

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Fraxinus excelsior, var: kabylia.—An Algerian variety of the common European or English Ash. This variety has proved the hardiest of all the family in South Africa, and is well worthy of trial at Rust-en-Vrede.

Juglans regia. Ordinary Walnut of Europe.—This native of Hungary and Greece has already been established in the Cango Valley and other parts of the Oudtshoorn district—principally as a fruit-bearing tree. In a suitable locality with a calcareous soil the tree may reach the height of 100 feet. The wood is light, tough, and frequently beautifully figured. It is much sought after for gun stocks, furniture, veneering, etc.

Juniperus virginiana. North American Pencil Cedar.—A tree reaching 75 to 100 feet and a diameter of 2 to 4 feet, this Cedar is one of the most widely distributed of the American coniferæ. Preferring gravelly ridges or limestone hills it reaches its greatest development in the valley of the Red River, Texas. It is very hardy against frost and drought but is somewhat slow growing. The wood is light, soft, not strong, very close and straight grained, compact, easily worked, odorous and very durable in contact with the ground. It is used for posts, sills, railway sleepers, interior finish, cabinet making and almost exclusively for pencils, and is probably one of the most valuable timbers of the world.

When it can be successfully grown it will prove a very valuable forest asset. It fully merits an extended trial in the Zwartberg.

Pinus laricio. var :austriaca. Corsican Pine. — A pine of Southern Europe extending to an altitude of 6,000 feet and reaching a height of 150 feet. Succeeds in stiff clay as well as in sandy soil but grows best on calcareous soils. Its growth has proved somewhat slow in the coast district of South Africa and even in the higher altitudes of Natal.

The wood is resinous, coarse grained, elastic and durable, and is much esteemed for building purposes, especially water works and where a timber is required for contact with the ground. It is probably one of the most valuable pine-woods of Europe.

Pinus halepensis. Aleppo Pine.—A pine found principally in Southern Europe, North Africa, and South Western Asia.

It attains a height of some 80 feet and a diameter of some 6 to 8 feet. Specimens are to be seen in the old George Drostdy grounds. It has proved hardy to frost and drought in South Africa and while it flourishes naturally best in coast lands has done well in the inland parts of the Colony. The timber is of pale colour, rather coarse and brittle, but is used for ship and general building and for furniture and may be regarded as generally serviceable.

Pinus Canariensis. Canary Island Pine.—Found naturally in the Canary Islands—in pure forest—at an altitude of about 5,000 feet, where it reaches a height growth of about 100 feet. The timber is resinous and durable, and fairly valuable.

In South Africa it has proved somewhat slow growing at least in the lower coast altitudes, but will probably shew better results in the mountains at from 2,000 to 3,000 feet.

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Pinus insignis. Insignis or Notable Pine.—This pine, known locally and in America as the "Monterey Pine" is a native of California, and is somewhat rare and local naturally, being found in sandy soil in the immediate neighbourhood of the sea coast. At present it is very largely cultivated on the Pacific Coast for shelter and ornament.

Reaching a height of 100 feet and a diameter of 3 to 4 feet, with beautiful dark green foliage this is one of the handsomest pines in America. The wood is light, soft, not strong, brittle, close grained and compact and is used for various purposes.

In cultivation it is probably the quickest growing of all pines, and it certainly is in South Africa, where it has been extensively and successfully introduced. It is somewhat subject to disease and to insect attack. In Europe it suffers much from the Pine Beetle (*Hylutgus Piniperda*), and in South Africa, at Fort Cunnynghame, Cape Colony from the caterpillar of a large moth (*Antheræa cytherea, Fab.*). At Tokai, Concordia and elsewhere a fungus disease (*Hysterium pinaster, Scrad. etfries*) has been noticed on the foliage but principally I think in its saprophlytic form. This is not to be feared in drier localities.

In spite of these drawbacks its many advantages call for its cultivation wherever possible and it is certainly to be recommended for Rust-en-Vrede.

From the foregoing it will be seen that the seventeen species enumerated, while limited in number, will if successfully established, provide for the more important requirements to which timber trees are put. A short recapitulation may be here convenient.

Useful for Forest Cover.

Eucalyptus corynocalix, E. crebra, E. diversicolor, E. globulus, E. sideroxylon, and *E. tereticornis, Cupressus macrocarpa,* and *C. torulosa, Juniperus virginiana, Pinus laricio, P. insignis, P. Canariensis,* and *P. halepensis.*

Useful for Wind Breaks.

Eucalyptus diversicolor, E. globulus, E. sideroxylon, and *E. tereticornis, Cupressus macrocarpa,* and *C. torulosa, Pinus insignis, P. halepensis, P. Canariensis,* and *P. laricio.*

Useful for Shade.

Eucalyptus corynocalix, E. diversicolor, and *E. globulus, Juglans regia, Pinus laricio, P. halepensis, P. Canariensis,* and *P. insignis.*

Useful for Fuel.

Eucalyptus corynocalix, E. diversicolor, E. globulus, and *E. tereticornis, Castanea sativa, Robina pseud-acacia, Pinus laricio, P. Canariensis.*

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USEFUL FOR POSTS, RAILWAY SLEEPERS, AND OTHER UNDERGROUND PURPOSES.

Eucalyptus corynocalix, E. crebra, E. sideroxylon, and *E. tereticornis, Castanea sativa, Robinia pseud acacia; Cupressus macrocarpa, C. torulosa, Juniperus virginiana, Pinus laricio* and *P. Canariensis.*

USEFUL FOR PILES.

Eucalyptus globulus, E. diversicolor, and *E. tereticornis; Cupressus torulosa,* and *C. macrocarpa; Pinus laricio* and *P. Canariensis.*

USEFUL FOR TELEGRAPH POLES.

Eucalyptus sideroxylon, and *E. tereticornis; Castanea sativa, Cupressus torulosa, Juniperus virginiana* and *Pinus laricio.*

USEFUL FOR VEHICLE MAKING.

Eucalyptus corynocalix, E. diversicolor, and *E. globulus; Castanea sativa; Fraxinus excelsior, var. kabylia, Juniperus virginiana.*

USEFUL FOR AGRICULTURAL IMPLEMENTS ETC.

Eucalyptus corynocalix, E. diversicolor, E. globulus, and *E. tereticornis; Castanea sativa, Robinia pseud-acacia, Fraxinus excelsior var. kabylia; Pinus laricio, Pinus Canariensis* and *P. insignis.*

USEFUL FOR FURNITURE AND GENERAL CABINET MAKING.

Eucalyptus globulus, E. diversicolor, and *E. corynocalix, Castanea sativa, Robinia pseud-acacia, Cupressus macrocarpa* and *C. torulosa, Fraxinus excelsior, var. kabylia, Juglans regia, Juniperus virginiana, Pinus laricio, P. halepensis, P. Canariensis.*

USEFUL FOR GENERAL BUILDING PURPOSES AND JOINERS' WORK.

Eucalyptus diversicolor, E. globulus, E. corynocalix, E. tereticornis, E. crebra and *E. sideroxylon; Castanea sativa; Cupressus macrocarpa,* and *C. torulosa; Fraxinus excelsior, var. kabylia, Juniperus virginiana, Pinus laricio, P. halepensis, P. Canariensis and P. insignis.*

From the foregoing a fair selection may be made according to requirements. Some species may not prove successful and some perhaps warrant only a limited trial.

For extensive planting I would recommend the whole of the Eucalypts given, viz:—*E. corynocalix, E. diversicolor, E. globulus E. tereticornis, E. sideroxylon, E. crebra,* as they will all probably prove successful. Of the cypresses both may be tried fairly extensively in the better localities as may be *Pinus insignis* and *Pinus halepensis.* More limited should be the plantings of *Pinus laricio, P. Canariensis, Juniperus virginiana* and *Fraxinus excelsior, var. kabylia,* while only experimental plots should be laid out for *Castanea sativa* and *Robinia pseud-acacia,* in localities more or less free from lime. *Juglans regia* may prove profitable as a fruit-bearer

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where occasional irrigation is possible and the wood, if slow growing, is valuable.

Many other species are likely to prove adaptable to the conditions at Rust-en-Vrede and while it is not advisable to undertake any extensive experimental work I would recommend that an *arboretum* be established where a few specimens of each species may be tried, in order to gauge their suitability to the locality.

Among these I may mention as trees of considerable economic value: *Eucalyptus pilularis, E. leucoxylon, E. rostrata, E. rudis* and *E. polyanthema; Cupressus Lawsoniana, C. obtusa* and *C. lusitanica; Platanus orientalis, Populus monilifera, Quercus ægilops, var.: vallonea, Q. ruber* and such others as may from time to time be considered as probable.

With the appointment of a capable superintendent, the Council should rely on success attending their venture, the general lines of which have been indicated only, though if any further information or advice be required I shall be pleased to render any assistance in my power on the occasion of my periodical visits to Oudtshoorn or at any other time when a personal inspection is not entailed.

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